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Impact of noise exposure on workers' health in the petrochemical industry

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ABSTRACT

Noise is one of the harmful physical factors in the workplace that affects the health of people exposed to it. This cross-sectional study was conducted on 186 petrochemical industry workers in 2024. Then, the systolic and diastolic blood pressures of the subjects were measured, and blood samples were sent to the laboratory to determine the triglyceride and cholesterol levels. ISO 15666 questionnaires were used to assess noise annoyance. The mean heartbeat rate was significantly higher in the case group (81.79±2.83) than that in the control group (77.11±9.10), suggesting that exposure to loud noise can induce physiological stress and elevate heartbeat rates (p-value< 0.001). The results showed a significant difference between the systolic and diastolic blood pressures of the case group and the control group (P <0.005). Based on the results of this study, noise can be considered as one of the factors affecting the heart and blood vessels in exposed people. This study can also help inform the policies of the Ministry of Health regarding the supervision of periodic examinations of workers in industries in the control of cardiovascular diseases.

Highlights

- Workers exposed to noise above 90 decibels had higher systolic blood pressure than control groups.
- The results of this study showed that noise affects blood cholesterol.
- Noise annoyance can be one of the secondary effects affecting blood pressure.
- Personal protective equipment alone cannot prevent the psychological effects of noise.

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1. Introduction

Occupational injuries impose a significant burden on workers across various industries, both from health and economic perspectives (He et al., 2025). However, improper safety and health conditions in workplaces expose most workers to numerous occupational hazards, which not only jeopardize their health and safety but also impair their performance (Kahya, 2007). Noise is one of the most common occupational hazards, raising serious concerns and affecting millions of workers worldwide, particularly in industrial areas, due to its negative impact on workers' health (Teixeira et al., 2019; Wang et al., 2021). The term 'noise' refers to noises that are annoying and intense, created by noise waves at various frequencies (Reybrouck et al., 2019). According to some researchers, 'noise' encompasses any type of audible noise energy that adversely affects people's physiological and mental health (Liu et al., 2020). Kerns et al. (2018) found that approximately 25% of workers across different industries in the US (equivalent to 39 million workers) are exposed to occupational noise. Occupational noise has long been a source of concern due to its impact on health, particularly auditory and non-auditory disorders such as hearing loss, tinnitus, and cardiovascular diseases (Babisch, 2014; Hahad et al., 2019). Noise exposure in the workplace is responsible for approximately 16% of hearing loss in adults worldwide (Nelson et al., 2005; Themann & Masterson, 2019). If not prevented, hearing loss can lead to communication difficulties, social isolation, stress, and fatigue (Themann et al., 2013). Nonetheless, current emphasis is placed on the non-auditory effects of noise (Golmohammadi et al., 2022). Environmental stress triggers the release of stress hormones, such as cortisol, adrenaline, and noradrenaline, which are recognized as factors contributing to hypertension, atherosclerosis, and other cardiovascular disorders (Mayntz et al., 2024). The cardiovascular system is regarded as the most complex system in the human body, which is why it has drawn the greatest attention (Wang et al., 2022; Das et al., 2024). In addition, noise-induced stress exacerbates sleep disorders, which, in turn, increases the risk of cardiovascular diseases (Recio et al., 2016). The literature identifies other noise characteristics, such as frequency and exposure duration, as factors determining the non-auditory effects of noise (Monteiro et al., 2018). Besides noise characteristics, it is important to note that demographic variables, such as age, work experience, personality traits, mental and social status, sensitivity to noise, and smoking, may also influence the non-auditory effects of noise (Abbasi et al., 2023). Sakthivel et al. (2025). concluded that 57% of workers were exposed to noise levels exceeding the threshold limit values (TLVs) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). Additionally, workers' mean systolic and diastolic blood pressures were reported as 135.33±17.3 mm Hg and 90.13±11.87 mm Hg, respectively (Sakthivel et al., 2025). Evidence indicates that occupational noise exposure may be gradually decreasing in some developed countries, whereas it is increasing in many developing countries due to the economic transition from agriculture-based to industry-based economies (Fuente & Hickson, 2011; Monazzam Esmaielpour et al., 2022). In this respect, developing countries rank higher due to their reliance on older industries and technologies, as well as greater dependence on manual processes requiring more workforce (Jo & Baek, 2024). Consequently, evaluating the risk of non-auditory effects caused by noise exposure has become a prominent topic of discussion (Pretzsch et al., 2021). On the other hand, oil and gas-related industries are among the industries that have significant noise exposure problems (Monazzam et al., 2011; Dehghan et al., 2013).

Therefore, determining the noise exposure status of workers in these industries and evaluating the adverse effects of noise exposure on them, and improving the health of workers exposed to noise seems to be essential. Conducting this research is increasingly important given the special position of the oil and its derivatives industries in the country and the very high volume of human resources working in them, considering the destructive effects of noise on the health of workers in these industries.

In summary, as worker protection programs have focused on reducing workplace noise exposure to prevent hearing loss, safeguard mental and social well-being, and mitigate non-auditory diseases, particularly in highly noisy industries, this research aimed to assess the impact of noise exposure on worker health in the petrochemical industry. This study examined parameters of increased blood lipids or hyperlipidemia in workers exposed to noise above 85 dBA, which is characterized by high blood cholesterol and triglycerides and is associated with serious complications, including cardiovascular disease, stroke, and peripheral vascular disease, which have received less attention in studies of worker exposure to noise. Therefore, the findings can assist health policymakers and experts in designing intervention programs to enhance health protection and implementing stricter policies to support worker health in noisy industries.

2. Materials and Methods

2.1 Study environment and worker selection method

This cross-sectional study was conducted in a petrochemical industry in 2022. Among all the workers of the company, 93 workers who were exposed to high noise levels (above 85 dBA) were in the case group, and another 93 workers from office areas who were exposed to lower noise levels (dBA 85) were in the control group were chosen. A few days before the study, the participants were informed about the necessary information about how to participate in the study, and after that, the informed consent form was provided to the participants, and informed written consent was obtained.

2.2 Noise measurement

The noise measurement was done using a calibrated noise meter model SVAN Tek971. To determine the noise exposure of people, first, all workstations were determined for each person. Then, in all locations, the equivalent level of noise in a frequency-weighting was measured for 15 minutes as a representative of the level of exposure in that location (considering that in each determined station, the noise level was less than 5 dBA, 15 minutes. The measurement was extended to the entire time the worker was employed at that station. In the following, according to the time of presence in all the stations and also the noise equivalent level of the said stations, the equivalent level of 8 hrs of people was obtained based on the formula in the ISO 9612 standard (Manvell, 2024). Eq. 1 presents the 8-hour noise equivalent level(dBA):

$$LAeq,T = 10\log\left(\frac{1}{T}\sum_{i=1}^{m} Ti.10^{LAeq,Ti/10}\right) \quad (1)$$

Then, based on the level of noise exposure, people were divided into two exposure groups (exposure more than 85 dBA) and a control group (exposure less than 85 dBA).

2.3 Cumulative noise Calculation

Cumulative noise exposure (CNE) was calculated for each person using Eq.2 (Chen et al., 2017). Eq. 2 presents the cumulative noise exposure:

$$\text{CNE(dBA)} = 10 \times \log\left(10^{\text{SPL}/10} \times \text{years of noise exposure}\right) \quad (2)$$

2.4 Personal, medical, and occupational information

In this study, firstly, the information of all people, including demographic information (age, work experience, body mass index, smoking, use of hearing protection equipment and shift work), medical records (including history of high blood pressure, diabetes, heart disease and or chronic kidney disease and the use of drugs affecting blood lipids) and job information was recorded using a direct interview method and a questionnaire method.

2.5 Blood pressure measurement

Then, the blood pressure of the subjects was measured in millimeters of mercury (mmHg) using a sphygmomanometer. People's blood pressure was measured three times in the morning before starting work and after sitting on a chair for 15 minutes, with an interval of at least 30 minutes from consuming food or physical activity, or smoking, and the average blood pressure was recorded as the person's blood pressure was reported.

2.6 Cholesterol and triglyceride measurement

In the next step, to determine blood cholesterol and triglyceride levels, volunteers were instructed not to eat fatty food the night before the test, and to refrain from alcohol, blood lipid-altering drugs, and vigorous exercise. On the other hand, they should fast for 10 to 12 hours before sampling and should not consume any other substance other than water. In the morning of the appointed day, blood samples were taken from the subjects and transported to the laboratory in a cold box. Cholesterol and triglyceride levels were determined by the glyceride oxidase method.

2.7 Body mass index measurement

In addition, to calculate the body mass index, people's height was measured using a tape measure, and their weight was measured using a digital scale.

2.8 Assessment of noise annoyance

People's noise annoyance based using the assessment of noise annoyance by means of social and socio-acoustic surveys was determined (Manvell, 2024).

In the scale presented in the ISO 15666 standard, the amount of noise annoyance is it is classified as no irritation, low irritation, moderate irritation, high irritation, and innate irritation. In this numerical scale, people chose their level of annoyance from 0 to 10 (Darvishi et al., 2019).

2.9 Study entry criteria

The criteria for entering the study were not taking drugs such as diuretics, corticosteroids, male sex hormones, and having no history of diseases such as hypothyroidism, diabetes, coronary artery disease, kidney disease, and liver disease (such as cirrhosis and hepatitis). Malnutrition or overactive thyroid, infection, and heart attack, excessive consumption of alcohol or drugs, in addition to verifying the information provided by the participants in the study, some questionnaires were randomly selected, and the information included in them was compared with the information in the workers' health records. In addition, because other environmental factors are almost the same for all participants (such as heat, humidity, workload, work environment, diet, etc.) in the workplace, the effect of these factors is the same for all people in this study.

2.10 Statistical analysis

Finally, the collected data were entered into SPSS V24 software for statistical analysis. An independent t-test was used to compare the mean blood pressure, triglyceride, and blood cholesterol in two groups with noise exposure more than 85 dBA (exposure group) and noise exposure less than 85 dBA (control group).

Moreover, for comparison, the average blood pressure, triglyceride, and blood cholesterol in the groups were used by an independent t-test for groups with two categories, and one-way analysis of variance was used for groups with three categories. In the analysis of variance, the hypothesis of homogeneity of variances was checked, and in cases where the hypothesis of homogeneity of variances was not established, the F-test was used. Finally, while controlling and adjusting the intervening variables, the effect of independent variables on dependent variables was investigated using a multivariate regression test.

3. Results and Discussion

3.1 Demographic

Table 1 describes the background and demographic variables for the case and control. According to Table 1, 62 workers in the case group and 49 in the control group used personal protective equipment. Also, the number of smokers and non-smokers in the case group was 30 and 63, respectively, compared to 67 and 26 in the control group, indicating no significant difference ($p < 0.316$). In other words, smoking had no significant effect on the results. This indicates a significant difference in the use of personal protective equipment between the two groups. Considering that the workers in the case group used hearing protection devices, the effect of noise on them was greater, which is because the hearing protection devices were not selected based on the prevailing noise level in the workplace.

Table 1 Description of contextual and demographic variables by separating the two groups of case and control.

Variables		Case group	Control group	p-value
Personal protective equipment	Yes	62	49	<0.036
	No	31	44	
Smoking	No	63	67	<0.316
	Yes	30	26	
Shift work	Morning	61	61	<0.0001
	Afternoon	32	32	

Table 2 compares the mean values of the background and demographic variables for the case and control groups. The results indicate no significant differences in mean age, height, weight, body mass index, and work experience, demonstrating that the two groups were comparable in these basic characteristics (p-value>0.05).

Table 2 Comparison of the means of background and demographic variables by case and control groups

Variables	Case group	Control group	p-value
	Men±SD	Men±SD	
Age (Years)	40.13±7.11	39.95±6.64	>0.386
Height (cm)	175.76±4.22	174.69±4.04	>0.078
Weight (kg)	76.05±3.27	75.47±3.03	>0.211
BMI (kg/m^2)	19.02±3.33	19.52±3.88	>0.340
Experience (yrs)	16.34±3.66	16.08±3.50	>0.610
Triglyceride (mg/dl)	192.09±59.08	180.16±34.42	>0.095
Cholesterol (mg/dl)	192.08±46.40	184.72±30.84	>0.209
Blood pressure systolic (mmHg)	13.53±1.41	12.74±1.32	<0.001
Blood pressure diastolic (mmHg)	8.75±0.81	8.39±0.90	<0.005
Noise exposure (dBA)	87.15±3.14	78.79±8.09	<0.001
Cumulative noise exposure (dBA)	89.22±3.87	82.53±7.26	<0.001
noise annoyance	8.53±0.82	6.94±1.21	<0.001
Heart rate (beat/min)	81.79±2.83	77.11±9.10	<0.001
Uric acid (ml/dl)	6.185±2.15	5.59±1.36	<0.026

Table 3 Comparison of triglyceride level, blood pressure, and cholesterol according to variable grouping

Variables	Groups	N	Blood pressure systolic		Blood pressure diastolic		Triglyceride		Cholesterol	
			Men±SD	p-value	Men±SD	p-value	Men±SD	p-value	Men±SD	p-value
Cumulative noise exposure (dBA)	<85	78	12.91±1.28		8.57±0.86	0.974	186.76±49.23		192.3±39.91	
	85-90	74	13.24±1.46	0.14	8.56±0.89		190.26±56.64	0.354	186.1±34.7	0.512
	>90	34	13.44±1.61		8.6±.94		175.68±22.91		184.2±47.83	
Age (Years)	25-35	53	13.33±1.66		8.66±0.99	0.675	201.13±65. 81	0.029	197.85±53.52	
	36-46	89	13.08±1.35	0.475	8.55±0.91		179.74±44.68		185.6±35.32	0.064
	47-57	44	13.02±1.27		8.51±.0.67		180.89±24.3		181.4±22.09	
Experience (Years)	<10	82	13.16±1.39	0.987	8.54±0.91	0.807	192.54±61.57	0.271	187.48±35.21	
	10-20	78	13.12±1.4		8.62±0.89		180.19±35.81		192.02±47.46	0.401
	>20	26	13.11±1.56		8.51±0.79		183.65±35.28		180.15±21.52	

Table 3 compares the groups in terms of triglyceride, blood pressure, and cholesterol levels. According to the results, workers exposed to > 90 dBA noise had higher systolic blood pressure (13.44 ± 1.61) than the other groups. However, this difference was not statistically significant (p-value = 0.14). Similarly, the groups did not differ significantly in diastolic blood pressure. Regarding the effect of age on workers' health, Table 4 presents the results of testing interpersonal effects to examine the effect of independent variables on dependent variables. This analysis investigates how factors such as noise exposure, use of protective equipment, working shifts, and work experience impact health variables, including systolic and diastolic blood pressure, triglyceride levels, and cholesterol levels.

Table 4 Interpersonal effects test to investigate the effect of independent variables on dependent variables.

Variables	Multivariateanalysis		Univariate analysis							
	Pillai's Trace	p-value	Systolic blood pressure		Diastolic blood pressure		Triglyceride		Cholesterol	
			η² (partial)	p	η² (partial)	p	η² (partial)	p	η² (partial)	p
Noise exposure (dBA)	0714	<0.001	0.286	<0.011	0.136	<0.041	0.198	<0.043	0.186	>0.042
Noise annoyance	0.218	<0.004	0.130	<0.001	0.121	<0.001	0.019	>0.621	0.012	>0.828
Cumulative noise exposure (dBA)	0.645	0.395	0.136	0.688	0.125	0.798	0.117	0.855	0.174	0.309
Personal protective equipment	0.033	0.189	0.007	0.793	0.001	0.606	0.028	0.023	0.007	0.265
Shift work	0.042	0.098	0.005	0.356	0	0.901	0.015	0.099	0.009	0.192
Experience (Years)	0.044	0.418	0.004	0.987	0.002	0.807	0.014	0.271	0.01	0.401

3.2 Effect of working shift

Regarding working shifts, a significant difference was found between the case and control groups (morning and afternoon shifts), implying the significant effect of working shifts on the results (p < 0.0001). This can be attributed to the varying noise and thermal conditions in workplaces, which affect workers in different shifts differently. For instance, noise levels may be lower at night than in the morning or afternoon. This finding corroborates the results reported by Mokhtar et al. (2007), who observed that, although minimum noise exposure requirements were met in Malaysia, workers were still significantly affected by noise. Therefore, there is an urgent need for managerial interventions to design effective programs aimed at mitigating the adverse effects of noise, improving health and safety, enhancing efficiency, and ensuring workers' comfort at work.

Noise exposure and cumulative noise exposure were significantly higher in the case group than in the control group, confirming that the case group was exposed to high levels of workplace noise (p-value < 0.001). As is evident in Table 2, the heartbeat rate was significantly higher in the case group than in the control group (81.79 ± 2.83 vs. 77.11±9.10). This indicates that noise exposure can increase physiological stress and heartbeat rate (p-value < 0.001). The case group also had significantly higher uric acid levels than the control group (6.18±2.15 vs. 5.59 ± 1.36; p-value <0.026). Elevated uric acid levels may be linked to oxidative stress and noise-induced physiological pressures. According to the tabular data, workers exposed to high noise levels in the petrochemical industry exhibited significantly higher heartbeat rates, diastolic blood pressure, and uric acid levels than the control group. Furthermore, high noise exposure increased workers' annoyance. These findings suggest that prolonged noise exposure may have adverse effects on workers' cardiovascular and overall health, emphasizing the need for measures to reduce exposure and improve working conditions. These results are consistent with those reported by Lai et al. (Lai & Huang, 2019), who found significant differences in heartbeat rate (p < 0.001), blood urea nitrogen (p < 0.001), uric acid (p = 0.014), and total cholesterol (p = 0.013) between workers in noisy environments and those in noise-free environments. Additionally, noise annoyance was significantly higher in the case group, further illustrating the impact of noise on workers' mental health (p-value < 0.001). The results of Monazzam et al., (2019) show that there is a significant relationship between the noise pressure level in the workplace and the level of mental effects perceived by employees. Studies have also shown that the mental effects of noise are associated with many psychological and cognitive disorders (Alimohammadi et al., 2019). Noise annoyance irritation is associated with disorders such as decreased concentration, memory impairment, and arousal (Farhang Dehghan et al., 2020).

3.3 Effect of age

Table 3 shows that individuals in the 25–35 age group had the highest triglyceride levels (201.13 ± 56.81), and this difference was statistically significant (p-value = 0.029). This suggests that younger individuals may be more prone to metabolic changes, such as elevated triglyceride levels, compared to other age groups. This finding aligns with the report by Kerns et al. (Kerns et al., 2018), on the effect of noise exposure on younger workers. In terms of work experience, workers with less than 10 years of experience exhibited higher triglyceride levels (192.54±61.57) and cholesterol levels (187.48 ± 35.21). However, the high p-values for these variables indicate that the differences were not statistically significant. While work experience may have a limited effect on triglyceride and cholesterol levels, these differences were not confirmed statistically.

Multivariate regression was used to investigate the effects of noise exposure level variables, noise annoyance, cumulative noise exposure, personal protective equipment, shift work, and work experience on systolic blood pressure, diastolic blood pressure, triglyceride, and blood cholesterol. For this purpose, the effect of intervening factors was adjusted using the above test.

Based on the results of Table 4, which shows that noise affects triglycerides and blood cholesterol, and increases triglycerides and blood cholesterol when exposed to occupational noise. Based on eta coefficients, the multivariate regression test showed that noise had a lesser effect on blood triglycerides than systolic and diastolic blood pressure. Also, the eta coefficient of the multivariate regression test shows that the effect of noise on diastolic blood pressure was lower than that of systolic blood pressure, triglyceride, and blood cholesterol of people exposed to noise.

The results of this study showed that exposure to noise pressure levels had a positive and significant effect on systolic and diastolic blood pressure, which was consistent with the results of Lee et al.'s study(Lee et al., 2009). Also, the results of this study are consistent with the studies of Tomei et al.(Tomei et al., 2000) and Chang et al., which showed that the systolic blood pressure of workers increased when exposed to noise(Chang et al., 2003). In addition, Sadeq et al.'s study showed that systolic and diastolic blood pressure have a positive correlation with occupational voice pressure level, which was consistent with this study(Sadeq et al., 2013). The review of studies conducted between 2000 and 2013 shows that there is a strong and positive correlation between exposure to occupational noise and previous vascular complications (Lyzwinski, 2014). However, the mechanism of the effect of noise on blood pressure is not yet clear; it can be assumed that noise as a stressor causes signals to the endocrine glands, and this action causes the release of stress hormones such as catecholamines (Babisch, 2003). Therefore, the release of catecholamines increases myocardial contraction and increases cardiac output and blood pressure (Münzel et al., 2014).

In general, the results of this study showed that noise affects blood cholesterol, which can be one of the mechanisms of increasing blood pressure when exposed to noise, which was consistent with Melamed et al.'s study (Melamed et al., 1997). Several studies have shown the effect of noise pressure level on cholesterol (Mohammadi et al., 2016). Studies have also shown the effect of stress and noise annoyance on blood pressure (Abbasi et al., 2015). In the present study, annoyance caused by noise exposure has shown itself as a factor affecting blood pressure based on Table No. 4. Also, Table 4 shows that noise annoyance can explain 13% of systolic blood pressure variance changes and 12% of diastolic blood pressure variance changes, but it had no effect on blood triglycerides and cholesterol. Epidemiological studies point to the relationship between cardiovascular disorders and blood pressure (Jarup et al., 2008). Neus et al.'s study has shown that annoyance caused by traffic noise increases blood pressure(Neus et al., 1983).

The results of this study show (Table 4) that the use of personal protective equipment did not affect blood pressure and other response variables, which is consistent with the study of (Chen et al., 2017). Also, table number 4 shows that by controlling variables such as hearing protection equipment, noise still had a significant effect on systolic and diastolic blood pressure with noise, and mentally (noise annoyance) can affect systolic and diastolic blood pressure. Therefore, it seems that the use of personal protective equipment alone cannot reduce the effect of noise because it cannot be a suitable method in controlling the mental effects of noise, such as noise annoyance.

This parameter can be explained by the fact that, although noise is primarily received through the auditory system, it may also be received by other parts of the body. Additionally, workers may lack proper training on how to use personal protective equipment, or the equipment purchased might not meet required standards. Therefore, such equipment must be selected based on the dominant frequency determined through noise frequency analysis; otherwise, workers will not fully benefit from its use, leading to poor compliance. Raising awareness about the correct use of this equipment through targeted programs is essential. This finding is consistent with a previous study on the effects of occupational noise exposure on workers' health in a factory (Lai & Huang, 2019).

Considering that the effect of noise annoyance on systolic and diastolic blood pressure is significant in Table 4, it can be acknowledged that noise has a direct (objective exposure to noise pressure level) and indirect (mental, such as noise annoyance) effect on systolic and diastolic blood pressure.

Based on the results of multivariable regression, noise exposure has increased the blood triglycerides of workers exposed to noise. Although few studies are available on the effect of noise on workers' blood triglycerides, their results are contradictory; this discrepancy could be due to the study design, the study samples, and the level of noise exposure (Mehrdad et al., 2011; Mohammadi et al., 2016). Table 4 shows that noise had a greater impact on systolic and diastolic blood pressure than cumulative noise, therefore, considering that cumulative noise is of the type of noise, but in this study, its effect on systolic and diastolic blood pressure was less, perhaps One of the reasons is that one of the main variables of cumulative noise is work experience, and according to the fact that work experience did not have a significant effect on systolic and diastolic blood pressure based on the results of Table 4, for this reason, it reduces the effect of cumulative exposure to noise on systolic and diastolic blood pressure.

4. Conclusion

In general, this study examined the effect of noise on workers' health, examining indicators such as systolic and diastolic blood pressure, as well as blood lipids, and the results are as follows:

1. Noise had a positive and significant effect on systolic and diastolic blood pressure, as well as cholesterol and triglycerides in the blood of the workers studied.

2. Although the mechanism of the effect of noise on blood pressure is not yet clear, this effect is caused both objectively (noise exposure) and subjectively (noise annoyance). Another factor affecting the systolic and diastolic blood pressure of the studied workers is noise annoyance; in other words, noise through the mind (noise annoyance) causes a harmful secondary effect on the blood pressure of the studied people.

3. The use of personal protective equipment alone cannot reduce the effect of noise because it cannot be a suitable method in controlling the mental effects of noise such as noise annoyance.

4. The effect of noise on systolic and diastolic blood pressure was greater than the cumulative noise that is from noise, perhaps one of the reasons is related to the work history, which is entered as a main variable, which requires There is more study that can be considered by researchers in future studies.

5. Blood pressure, high cholesterol levels, and noise annoyance are more prevalent among workers exposed to noise.

The limitations of this study were coordination with the petrochemical company, as well as convincing the workers, and the costs of the experiments. On the other hand, most of the workers were male, and it was not possible to participate in the study by both sexes (male and female). It is recommended that future studies investigate the mechanism of the effect of noise and the cause of increased blood lipids to prevent the spread of cardiovascular diseases in both men and women who are exposed to noise.

Statements and Declarations

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Data availability

Data will be made available on request.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author contribution

S. Nasrolahi: Investigation, Funding acquisition, Conceptualization; S. Sabzalipour: Writing – review & editing; M. Mohammadi Roozbahani: Writing, Validation; A. M. Abbasi: Methodology, Investigation, Conceptualization; S. Attarroshan: Conceptualization, Data curation, Formal analysis.

AI Use Declaration

During the preparation of this manuscript, the authors used ChatGPT for language translation. All content has been carefully reviewed and revised by the authors, who take full responsibility for the final version of the manuscript.

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